

CRUISE CONTROL SAFETY DISENGAGEMENT SYSTEM

FIELD OF INVENTION

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The invention generally relates to safety devices for motorized vehicles. The invention also generally relates to cruise control systems for motorized vehicles.

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BACKGROUND

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Motorized vehicles are typically equipped with a cruise control system for automatically maintaining the speed of a vehicle despite changes in the environment (*e.g.*, wind speed, and direction) or the terrain (*e.g.*, slope of the road). Cruise control systems are normally equipped with an interface system located on the steering column or steering wheel of the vehicle for allowing a driver to manually engage and disengage the cruise control system. Cruise control systems also normally include a brake release switch effective for allowing a driver to disengage the cruise control system by depressing the brake pedal.

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Cruise control provides significant benefits, particularly when driving long distances on restricted access roadways, such as the United States Interstate Highway system. However, situations often arise when a reduction in speed is appropriate in order to avoid an accident, but the driver is unable to disengage the cruise control system due to incapacitation of the driver (*e.g.*, seizure or heart attack), impairment of the driver (*e.g.*, alcohol impairment), drowsiness of the driver, or the need for quick and immediate evasive action (*e.g.*, avoidance of a deer, avoidance of road debris, fishtailing on ice or swerving caused by a flat tire). When such a situation is encountered, the cruise control continues to maintain the set speed of the vehicle despite the loss of control by the driver.

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Accordingly, a substantial need exists for a cruise control safety release system capable of automatically disengaging the cruise control system of a vehicle when a driver has lost control or is about to lose control of the vehicle. It is also important for consumer acceptance that the cruise control safety release system does not result in a significant number of "false" disengagements (*i.e.*, a normal operating condition incorrectly interpreted as a loss or impending loss of driver control, resulting in an unwanted and unnecessary disengagement of the cruise control system).

SUMMARY OF THE INVENTION

We have discovered a system for enhancing the safety of a cruise control system. The system, hereinafter referenced for convenience as the cruise control swerve release system, automatically disengages the cruise control system when the vehicle experiences a lateral acceleration (*e.g.*, swerving, fishtailing or cornering at an excessive speed) indicative of a situation which would benefit from a reduction in the speed of the vehicle.

Generally, the cruise control swerve release system includes (i) a sensor mounted upon a motorized vehicle equipped with a cruise control system for sensing lateral acceleration of the vehicle, and (ii) a controller in communication with the sensor and the cruise control system for disengaging the cruise control system when the sensor detects a lateral acceleration in excess of a predetermined threshold value.

More specifically, the cruise control swerve release system includes (i) an accelerometer mounted upon the vehicle so as to sense lateral acceleration of the vehicle and generate a lateral acceleration signal having a value proportional to the sensed lateral acceleration, and (ii) a controller in electrical communication with the accelerometer and the cruise control system for disengaging the cruise control system upon receiving a lateral acceleration signal in excess of a predetermined threshold value.

The invention further includes a method for automatically disengaging the cruise control system on a motorized vehicle when the vehicle experiences a lateral acceleration in excess of a predetermined threshold value. The method includes (i) sensing lateral acceleration of the vehicle, and (ii) disengaging the cruise control system when the sensor detects a lateral acceleration in excess of a predetermined threshold value.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a flowchart for an embodiment of the invention.

Figure 2 is an electrical schematic of an embodiment of the invention.

Figure 3 is a front view of an embodiment of the invention.

Figure 4a is a front view of an embodiment of the invention in the absence of lateral acceleration.

Figure 4b is a front view of the embodiment of the invention shown in Figure 4a subjected to lateral acceleration sufficient to open the normally closed switch.

Figure 5a is a front view of an embodiment of the invention in the absence of lateral acceleration.

Figure 5b is a front view of the embodiment of the invention shown in Figure 5a subjected to lateral acceleration sufficient to open the normally closed switch.

Figure 6 is a front view of an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION
INCLUDING A BEST MODE

5 *Nomenclature*

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FIG. 1

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- 100** Cruise Control Swerve Release System
- 101** Lateral Acceleration Sensor
- 102** Microcontroller
- 103** Swerve Release Switch
- 111** Pendulum
- 112** Cam
- 113** First Pair of Electrical Contacts
- 113a** Proximal Contact of First Pair of Electrical Contacts
- 113b** Distal Contact of First Pair of Electrical Contacts
- 114** Second Pair of Electrical Contacts
- 114a** Proximal Contact of Second Pair of Electrical Contacts
- 114b** Distal Contact of Second Pair of Electrical Contacts
- 115** Housing
- 116** Leaf Spring
- 117** Microswitch
- 121a** First Mercury Switch
- 121b** Second Mercury Switch
- 122** Mercury
- 123** Bulb
- 123d** Distal End of Bulb
- 123p** Proximal End of Bulb
- 124** First Pair of Electrical Contacts
- 125** Second Pair of Electrical Contacts
- Angle of Incline Relative to Gravity

- 200 Cruise Control Module
- 300 Brake Release Switch
- 301 Electrical Circuit for Brake Release Switch

5 **Construction**

The invention is a cruise control swerve release system **100** capable of automatically disengaging the cruise control system of a motorized vehicle when the vehicle experiences a lateral acceleration in excess of a predetermined threshold value. The system **100**, hereinafter
10 referenced for convenience as the cruise control swerve release system **100**, can be effectively utilized with any motorized vehicle equipped with a cruise control system including passenger vehicles, light duty trucks (*i.e.*, those equipped to carry one ton or less), heavy duty trucks (*i.e.*, those equipped to carry more than one ton), and semis.

The threshold value should be set at a value which is high enough to avoid accidentally disengaging the cruise control system (not shown) under normal operating conditions but low enough to disengage the cruise control system when the lateral acceleration is indicative of an impending loss of control by the driver (not shown) unless the speed of the vehicle (not shown) is reduced. Situations where the cruise control swerve release system **100** should disengage the
15 cruise control system include (i) swerving or high acceleration turns resulting from a driver's inability to control the vehicle due to the onset of a medical condition such a driver who has blacked-out or is experiencing a heart attack or seizure, (ii) swerving or high acceleration turns resulting from an evasive maneuver such as typically experienced when attempting to avoid a deer, road debris or another vehicle in the roadway, (iii) fishtailing on an icy road, (iv) swerving
20 or high acceleration turns resulting from the erratic driving of an impaired driver, (v) swerving or high acceleration turns resulting from the erratic driving of a drowsy driver, and (vi) swerving caused by a flat tire.

As shown schematically in Figure 2, one embodiment of the cruise control swerve release
30 system **100** includes a sensor **101** for detecting and measuring lateral acceleration of a motorized

vehicle and a switch **103** in communication with the sensor **101** and the cruise control module **200** for automatically disengaging the cruise control system when the sensor **101** detects a lateral acceleration in excess of a predetermined threshold value.

5 The cruise control swerve release system **100** can be operably connected to most standard cruise control systems without redesign of the cruise control system by positioning the swerve release switch **103** within the brake release electrical circuit **301**. Such a connection allows the swerve release switch **103** to utilize existing wiring (not shown) and the existing cruise release pin (not shown) on a typical cruise control module **200** to effect disengagement of the cruise
10 control system when the swerve release switch **103** is tripped.

As shown in Figure 2, a microcontroller **102** can be utilized for receiving the electrical lateral acceleration signal from the lateral acceleration sensor **101**, comparing the value of the lateral acceleration signal to the predetermined threshold value, and effecting disengagement of the cruise control system (not shown) when the lateral acceleration signal exceeds the
15 predetermined threshold value.

When an electrical lateral acceleration sensor **101** is employed, such as an accelerometer, those electrical components typically employed to amplify and condition the signal may be
20 employed in accordance with standard industry practice to ensure transmission and receipt of an accurate and appropriate signal from the lateral acceleration sensor **101** to the microcontroller **102**.

Accelerometers can provide a signal that is proportional to the lateral acceleration of the
25 motor vehicle. Any of the various known accelerometers can be utilized. These include sensors such as disclosed in United States Patent Nos. 4,023,864 issued to Lang et al., 4,908,767 issued to Scholl et al., 5,063,782 issued to Kellett, 5,269,187 issued to Hanson, 5,369,580 issued to Monji et al., 5,473,930 issued to Gademann et al., 5,548,273 issued to Nicol et al., 5,742,918 and 5,742,919 issued to Ashrafi et al., 5,878,357 issued to Sivashankar et al., 6,130,608 issued to
30 McKeown et al. the disclosures of which are incorporated by reference.

Suitable accelerometers are commercially available from a number of sources including Entran Devices, Inc. of Fairfield, New Jersey and Digi-Key Corporation of Thief River Falls, Minnesota.

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As shown in Figure 3, a simple mechanical system capable of automatically disengaging the cruise control system of a motorized vehicle when the vehicle experiences a lateral acceleration in excess of a predetermined threshold value includes a pendulum **111** attached to a rotatable cam **112**, with the cam **112** positioned and arranged to engage and open a paired set of normally closed electrical contacts **113** and **114** positioned on either side of the cam **112**. The mechanical cruise control swerve release system **100** is retained within a protective housing **115** and mounted upon the vehicle so that the pendulum **111** swings in proportion to the lateral acceleration experienced by the vehicle. The cam **112** is positioned relative to the normally closed electrical contacts **113** and **114** such that the cam **112** will deflect the distal contact **113b** or **114b** away from the associated proximal contact **113a** or **114a** respectively, thereby opening the paired electrical contacts **113** or **114** and disengaging the cruise control system whenever the pendulum **111** swings a sufficient distance to either side.

A second mechanical system capable of automatically disengaging the cruise control system of a motorized vehicle when the vehicle experiences a lateral acceleration in excess of a predetermined threshold value is shown in Figures 4a and 4b. The system shown in Figures 4a and 4b includes a pendulum **111** attached to a rotatable cam **112**. The cam **112** is positioned and arranged to engage and deflect a leaf spring **116** when the pendulum **111** swings a sufficient distance to either side. The leaf spring **116** is fixedly attached and in electrical communication with a first electrical contact **113**, and biased into electrical contact with a second electrical contact **114**. The mechanical cruise control swerve release system **100** is retained within a protective housing **115** and mounted upon the vehicle so that the pendulum **111** swings in proportion to the lateral acceleration experienced by the vehicle. The cam **112** is positioned relative to the normally closed electrical contacts **113** and **114** such that the cam **112** will deflect the leaf spring **116** away from the second electrical contact **114** so as to open the electrical circuit

and disengaging the cruise control system whenever the pendulum **111** swings a sufficient distance to either side.

A third mechanical system capable of automatically disengaging the cruise control system of a motorized vehicle when the vehicle experiences a lateral acceleration in excess of a predetermined threshold value is shown in Figures 5a and 5b. The system shown in Figures 5a and 5b includes a pendulum **111** attached to a rotatable cam **112**. The cam **112** is positioned and arranged to engage and open a normally closed standard microswitch **117** when the pendulum **111** swings a sufficient distance to either side. The mechanical cruise control swerve release system **100** is retained within a protective housing **115** and mounted upon the vehicle so that the pendulum **111** swings in proportion to the lateral acceleration experienced by the vehicle. The cam **112** is positioned relative to the normally closed microswitch **117** such that the cam **112** will engage and open the microswitch **117**, and thereby disengage the cruise control system, whenever the pendulum **111** swings a sufficient distance to either side.

As shown in Figure 6, another suitable mechanical system capable of automatically disengaging the cruise control system of a motorized vehicle when the vehicle experiences a lateral acceleration in excess of a predetermined threshold value employs a pair of inclined mercury switches **121a** and **121b** such as disclosed in United States Patent No. 4,213,116 issued to Holtzman, the disclosure of which is incorporated by reference. The mercury switches **121a** and **121b** are mounted upon the vehicle so that lateral acceleration of the vehicle causes the mercury **122** within one of the bulbs **123** to ascend towards the proximal end **123p** of the bulb and away from the electrical contacts **124** or **125**. The bulbs **123** are positioned as mirror images so that one switch **121a** is operable when the lateral acceleration is to the left and the other switch **121b** is operable when the lateral acceleration is to right. The bulb **123** for each switch **121a** and **121b** is inclined at an angle θ effective for allowing the mercury **122** contained within the bulb **123** to ascend and lose contact with the exposed end of at least one of the electrical contacts **124** or **125** positioned near the distal end **123d** of the bulb **123**, thereby opening the switch **121a** or **121b**, only when the lateral acceleration exceeds the predetermined lateral acceleration threshold value.

As can be appreciated from this disclosure, a wide variety of electrical and mechanical switches can be used in the cruise control swerve release system **100** of the invention so long as the switch is able to withstand the harsh environmental (*e.g.*, temperature extremes) and use conditions (*e.g.*, continuous vibration and exposure to water, salt, mud and grime) to which the switch will be exposed. The cruise control swerve release system **100** of the invention can be constructed to utilize a normally open or normally closed switch as desired.

Lateral acceleration may alternatively be calculated from measurements of steering angle and vehicle speed as set forth in United States Patent Nos. 5,276,624 issued to Ito et al., 5,369,580 issued to Monji et al., 5,878,357 issued to Sivashankar et al. the disclosures of which are incorporated by reference.

Use

The cruise control swerve release system **100** of the invention is effective for automatically disengaging the cruise control whenever the vehicle experiences a lateral acceleration indicating an actual or potential loss of control by the driver and a need to reduce the speed of the vehicle. Referring to Figure 1, the cruise control swerve release system **100** is automatically activated when the cruise control is engaged. In the event, the cruise control is disengaged, such as by depressing the brake so as to trigger the cruise control brake release switch **300**, the cruise control swerve release system **100** is no longer necessary and will resume functioning again when the cruise control is engaged. The cruise control swerve release system **100** can optionally remain activated although the cruise control is not engaged, but the cruise control swerve release system **100** will have no operational effect upon the cruise control system until the cruise control system is engaged.

While the cruise control swerve release system **100** is activated, lateral acceleration is sensed, measured and compared, either mechanically or electronically, to a threshold value.

When the sensed lateral acceleration exceeds the threshold value, the cruise control is automatically disengaged and the vehicle allowed to slow.

While preferred embodiments of the invention have been described, it should be understood that various changes, adaptations and modifications may be made to the invention without departing from the spirit of the invention and the scope of the appended claims.